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10/561,433	12/19/2005	Jurgen Schulz-Harder	A-9800	6344

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EXAMINER	
SMITH, COURTNEY L	
ART UNIT	PAPER NUMBER
2835	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/561,433	SCHULZ-HARDER ET AL.	
	Examiner	Art Unit	
	COURTNEY SMITH	2835	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-7,9,11,12,14-27,29-34,36,37,39-42,44,46,47 and 49-58* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-7,9,11,12,14-27,29-34,36,37,39-42,44,46,47 and 49-58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 December 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☒ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1-2, 4-7, 9, 11-12, 14-15, 17-25, 27, 36-37, 39, 41-42, 44, 46-47, 49-58,** are rejected under 35 U.S.C. 103(a) as being unpatentable over **(Dani 2003/0077478)** in view of **(Knowles 7,144,624).**

Regarding Claims 1, 27, 36, Dani discloses an apparatus **(Fig. 3)** with a heat source **(12)** comprising at least one electronic component **(Detailed Descriptions 0013)** with a heat sink **(14)** and with an intermediate layer/thermal mass **(10)** made of a thermally conductive material **(Detailed Descriptions 0013)** provided between the heat source and the heat sink, wherein the intermediate layer consists of an organic matrix **(16)** with embedded nanofibers **(carbon nanotubes-20--Detailed Description 0021),** wherein the organic matrix is already in the viscous or liquid state at a temperature between 10 and 30°C **(as disclosed by Detailed Description 0023, where the matrix is only cured at room temperature, and thus any temperature between at least 10°C and 21°C constitutes an already viscous state);** and wherein the percentage of nanofibers in the matrix is between 5 and 20 percent by weight **(Detailed Description 0028, where matrix 16 is 8% of the total mass by weight)** in relation to the total mass of the intermediate layer. **Except, Dani** does not explicitly disclose the length of at least

a majority of the nanofibers embedded in the organic matrix is between 1-100 micrometers with the surface pressure against the intermediate layer between approximately 0.1 and 100 bar. However, **Knowles (Col. 2, lines 14-21; discloses transferring heat from a heat source to a heat sink via a plurality of carbon fibers)** discloses the length of at least a majority of nanofibers **(nanofibril formed of nanotubes—abstract)** embedded in the organic matrix **(carbon fiber interleaf gasket, where fibers are encapsulated in silicone gel—Col. 3, lines 46-49)** is between 1-100 micrometers **(50 microns—Col. 8, lines 55-59)** with a surface pressure against the intermediate layer between approximately 0.1 and 100 bar **(a few psi--Col. 8, lines 59-61; whereby a few psi equates to .2 bar).** It would have been obvious to one having ordinary skill in the art at the time that the apparatus of Dani with the nanofiber length and intermediate layer surface pressure of Knowles was made in order to provide a high thermal conductivity path from one surface to another and maintaining increased surface area contact while spanning uneven surface gaps.

Regarding Claims 2, 37, Dani discloses an apparatus **(Fig. 3)** to claim 1, wherein the organic matrix at least at the operating temperature of the heat source is in a viscous state **(Detailed Description 0013; wherein 16 is viscoelastic)**.

3. **Claims 4 &39,** are rejected under 35 U.S.C. 103(a) as being unpatentable over **(Dani 2003/0077478)** in view of **(Knowles 7,144,624)** as applied to claim 1 above, and further in view of **(Mita 6,663,964).**

Regarding Claims 4 & 39, Dani discloses the apparatus **(Fig. 3)** to claim 2, **except** explicitly disclosing the organic matrix is already in the liquid state being at a temperature between 40 and 80°C. However, **Mati** discloses organic matrix **(organic matrix--Col. 2, lines 66-67---Col. 3, liens 1-2)** already in the liquid state being at a temperature between 40 and 80°C **(as disclosed by Col. 3, lines 18-32).** It would have been obvious to one having ordinary skill in the art at the time that the invention was made to provide the already modified apparatus of Dani and Knowles with the organic matrix of Mati in order to improve thermal conductivity from the heat source to the heat sink and whereby lowering thermal contact resistance between there-between.

Regarding Claims 6, 41, Dani discloses an apparatus **(Fig. 3)** characterized in that claim 1, wherein the organic matrix contains at least only partially cross-linked elastomer **(Detailed Descriptions--0023)**.

Regarding Claims 7, 42, Dani discloses an apparatus **(Fig. 3)**, characterized in claim 1, wherein the organic matrix is at least partially a polymer **(polymer—as disclosed by Detailed Descriptions--0013)**.

Regarding Claims 9, 44, Dani discloses an apparatus according to claim 1, **except** explicitly wherein the nanofibers have a thickness between approximately 1.3 nm and 300 nm, where the length/thickness ratio of a majority of the nanofibers embedded in the organic matrix is greater than 10. It would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the length/thickness

ratio, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding Claims 11, 46, Dani discloses an apparatus **(Fig. 2)** according to claim 1, **except** explicitly wherein the thickness of the intermediate layer is between 0.01 mm and 0.5 mm. It would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the intermediate layer thickness, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding Claims 12, 47, Dani discloses an apparatus **(Fig. 2)** according to claim 1, wherein at least part of the nanofibers are made of boron nitride **(Detailed Description 0021).**

Regarding Claims 14, 49, Dani discloses an apparatus **(Fig. 2)** according to claim 1, wherein the nanofibers in the organic matrix are oriented in a random configuration **(as depicted in Fig. 2).**

Regarding Claims 15, 50, Dani discloses an apparatus **(Fig. 2)** claim 1, **except** explicitly wherein the nanofibers in the organic matrix at least for the most part are oriented perpendicular to the heat transfer surfaces. However, **Knowles** discloses

nanofibers in the organic matrix at least for the most part are oriented perpendicular **(as depicted in Fig. 1B, where 26 is perpendicular to surfaces; and further disclosed by col. 3, lines 30-36)** to the heat transfer surfaces. It would have been obvious to one having ordinary skill in the art at the time that the apparatus of Dani with the nanofiber orientation of Knowles in order to provide a high thermal conductivity path from one surface to another and maintaining increased surface area contact while spanning uneven surface gaps.

Regarding Claims 17, 51, Dani discloses an apparatus **(Fig. 2)** claim 1, wherein at least part of the nanofibers embedded in the organic matrix form a two-dimensional structure **(as depicted in Fig. 2),** in which the nanofibers are linked with each other, in the form of a network.

Regarding Claims 18, 52, Dani discloses an apparatus **(Fig. 2)** claim 1, wherein the organic matrix contains further components or additives **(Detailed Description 0016; where 18 is 5% by weight),** in a percentage that is lower than the percentage of nanofibers **(Detailed Description 0019; where 20 is 10% by weight).**

Regarding Claims 19, 53, Dani discloses an apparatus **(Fig. 2)** to claim 18, wherein the organic matrix contains at least one thermally conductive BN ceramic **(Detailed Description 0021).** in the form of fine particles or powder as an additive.

Regarding Claims 20, 23, 54, 57, Dani discloses an apparatus **(Fig. 2)** to claim 18, wherein the organic matrix contains as an additive at least one metal in the form of fine particles **(Detailed Description 0018).**

Regarding Claims 21, 55, Dani discloses an apparatus **(Fig. 2)** claim 18, wherein the matrix contains as an additive, in the form of fine particles at least one material that is heat-conductive, and changes to molten state at temperatures above 50°C **(Detailed Description 0017)**

Regarding Claims 22, 56, Dani discloses an apparatus **(Fig. 2)** characterized in that claim 1, wherein at least part of the nanofibers are nanotubes **(Detailed Description 0021).**

Regarding Claims 24, 58, Dani discloses an apparatus **(Fig. 2)** characterized in that claim 1, wherein the nanofibers made of carbon are such nanofibers that were subjected before being embedded in the organic matrix to a heat treatment at a temperature between 2700 - 3100°C. It would have been obvious to one having ordinary skill in the art at the time the invention was made to vary the set point at which the material changes to a molten state, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. **It is to be**

further noted that the Examiner will not give any patentable weight to a process claim. See MPEP 2113.

Regarding Claim 25, Dani discloses an apparatus **(Fig. 2)** characterized in that claim 1, wherein the heat source is formed by at least one electronic component, such as IC **(Detailed Description 0025).**

4. **Claim 16,** are rejected under 35 U.S.C. 103(a) as being unpatentable over **(Dani 2003/0077478)** as applied to claim 1 above, in view of **(Yaniv 6,312,303),**
Regarding Claim 16, Dani discloses an apparatus **(Fig. 2)** according to claim 15, **except** explicitly further comprising means for orienting and/or maintaining the orientation of the nanofibers in the organic matrix, by means for creating an electric field intensity in the organic matrix. However, **Yaniv** discloses means **(201-Fig. 2--Col. 2, lines 44-50)** for orienting and/or maintaining the orientation of the nanofibers in the organic matrix, by means **(202)** for creating electric field intensity in the organic matrix. It would have been obvious to one having ordinary skill in the art at the time that the apparatus of Dani with the electric field orientation means of Yani was made in order to improve the efficiency of electron emissions for the electric field intensity.

5. **Claims 26, 32-34,** are rejected under 35 U.S.C. 103(a) as being unpatentable over **(Dani 2003/0077478)** as applied to claim 1 above, in view of **(Knowles 7,144,624),** in further view of **(Eckblad 6,407,922).**

Regarding Claim 26, Dani discloses an apparatus **(Fig. 2)** characterized in that claim 1, wherein the heat source is formed by at least one circuit or module with at least one electronic component which is located on a substrate **(34-Fig. 3)** wherein the intermediate layer is located between one metallization **(where 32 contacts 34, Detailed Description 0025)** of the substrate and one heat transfer surface **(surface of 14 which abuts 10)** adjacent to said metallization, **except** explicitly disclosing that the substrate includes metal-ceramic. However, **Eckblad** discloses a metal and ceramic substrate **(flip chip substrate-6 and multilayered ceramic board 9, Fig. 1—Col. 6, lines 1-8).** It would have been obvious to one having ordinary skill in the art at the time that the invention was made to provide the modified apparatus of Dani and Knowles with the metal-ceramic substrate of Eckblad in order to allow for an increased ability to spread heat; whereby having more reliability and reduced weight and/or leakage in comparison to the use of all metal which may require fluid systems to spread heat.

Regarding Claims 32-34, Dani discloses an apparatus **(Fig. 2)** according to claim 32, **except** explicitly wherein the heat pipe, wherein-at least one intermediate layer is provided between the heat pipe and a heat exchanger, wherein the heat pipe functions as a heat spreader. However, **Eckblad** discloses a heat pipe **(Col. 1, lines 28-32 and Col. 5, lines 41-44; wherein the heat pipe is suggested as a substitute for 5)**, wherein-at least one intermediate layer **(15, Col. 6, lines 14-17)** is provided between the heat pipe and a heat exchanger **(7),** wherein the heat pipe functions as a heat spreader **(Col. 5, lines 41-44).** It would have been obvious to one having ordinary skill

in the art at the time that the invention was made to provide the apparatus of Dani with the heat pipe of Eckblad in order to allow for an increased ability to spread heat; whereby having more reliability and reduced weight and/or leakage in comparison to the use of all metal which may require fluid systems to spread heat.

6. **Claims 5, 29-31, 40,** are rejected under 35 U.S.C. 103(a) as being unpatentable over **(Dani 2003/0077478)** as applied to claim 1, above, in view of **(Knowles 7,144,624),** in further view of **(Webb 6,542,371).**

Regarding Claims 5, 40, Dani discloses an apparatus **(Fig. 3)** to claim 1, wherein the organic matrix contains a silicone **(Detailed Description 0015), except** explicitly disclosing a silicone oil. However, **Webb** discloses an organic matrix contains at least one oil, such as silicone oil **(col. 4, lines 43-47; wherein carbon fiber fabric is impregnated with silicon oil).** It would have been obvious to one having ordinary skill in the art at the time that the invention was made to provide the modified apparatus of Dani and Knowles with the silicone oil of Webb in order to reduce the amount of air within the interface during operation, and thereby decreasing the thermal resistance therein.

Regarding Claim 29, Dani discloses an apparatus **(Fig. 2)** according to claim 1, **except** explicitly wherein the heat sink is formed by a passive cooler with cooling fins. However, **Webb** discloses a heat sink **(40-Fig. 3)** is formed by a passive cooler with cooling fins **(42).** It would have been obvious to one having ordinary skill in the art at

the time that the invention was made to provide the apparatus of Dani with the fins of Webb in order to increase the rate at which heat is transferred to the surrounding environment.

Regarding Claims 30-31, Dani discloses an apparatus **(Fig. 2)** according to claim 1, **except,** explicitly wherein the heat sink comprises at least one cooler where coolant **(liquid cooling--Col. 1, lines 39-43)** circulates. However, **Webb** discloses a heat sink comprises at least one cooler where coolant **(liquid cooling--Col. 1, lines 39-43)** circulates. It would have been obvious to one having ordinary skill in the art at the time that the invention was made to provide the apparatus of Dani with the liquid cooler of Webb in order to increase the rate at which heat is transferred to the surrounding environment.

Response to Arguments

7. Applicant's arguments with respect to claims **1-2, 4-7, 9, 11-12, 14-16, 17-27, 29-34, 36-37, 39, 40-42, 44, 46-47, 49-58,** have been considered but are moot in view of the new ground(s) of rejection. In response to the applicant's comments pertaining to the Knowles reference being published after the priority date (06/17/03) of the application, the Examiner notes that Knowles filing date (02/08/02) presents a sufficient 102(e) date to deem appropriate the 103 rejection that includes Knowles.

The Examiner further notes the amended language in base claims 1 and 36 includes new limitations: wherein the percentage of nanofibers in the matrix is between 5 and 20 percent by weight in relation to the total mass of the intermediate layer, and thus new rejections have been made for claims 1, 4, 36, and 39.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY L. SMITH whose telephone number is (571)272-9094. The examiner can normally be reached on Monday-Friday 7:30a-5p (1st Fri. off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jayprakash Gandhi can be reached on 571-272-3740. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. S./

/Jayprakash N Gandhi/

Supervisory Patent Examiner, Art Unit 2835